Claims

1. An organic electroluminescent device having a multilayer structure comprising at least an emitting layer and an electron-transporting layer between a cathode and an anode, the triplet energy gap (Eg^T) of a host material forming the emitting layer being 2.52 eV or more and 3.7 eV or less, an electron-transporting material forming the electron-transporting layer being different from the host material, and having hole-transporting properties, and the emitting layer comprising a phosphorescent metal complex compound containing a heavy metal.

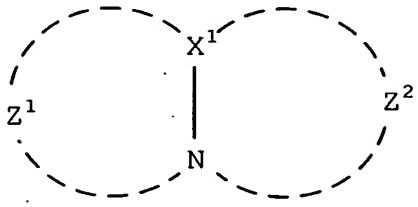
2. The organic electroluminescent device according to claim 1, wherein the ionization potential (Ip) of the electron-transporting material forming the electron-transporting layer is 5.6 eV or more and less than 6.0 eV.

3. The organic electroluminescent device according to claim 1, wherein the electron-transporting material forming the electron-transporting layer is at least an electron-deficient nitrogen-containing five-membered ring derivative or a nitrogen-containing six-membered ring derivative.

4. The organic electroluminescent device according to claim 1, wherein the electron-transporting material has one or more

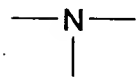
of the following structures (1) to (3).

Five-membered ring or six-membered ring containing =N- skeleton (1)



(2)

wherein X^1 is a carbon atom or a nitrogen atom, and Z^1 and Z^2 are independently atom groups which can form a nitrogen-containing hetero ring



(3)

5. The organic electroluminescent device according to claim 1, wherein the electron-transporting material has a nitrogen-containing aromatic polycyclic group containing a five-membered ring or six-membered ring, and when the group contains a plurality of nitrogen atoms, the organic compound has a skeleton containing the nitrogen atoms in non-adjacent bonding positions.

6. The organic electroluminescent device according to claim 1, wherein the electron-transporting material or the host material is a compound having one carbazolyl group or

tetrahydrocarbazolyl group.

7. The organic electroluminescent device according to claim 1, wherein the electron-transporting material or the host material is a compound having two carbazolyl groups or tetrahydrocarbazolyl groups.

8. The organic electroluminescent device according to claim 1, wherein the electron-transporting material or the host material is a compound having a carbazolyl group or a tetrahydrocarbazolyl group, and a nitrogen-containing hetero ring group.

9. The organic electroluminescent device according to claim 1, wherein a difference (ΔIp = Ip(electron-transporting material) - Ip (host material)) in ionization potential between the host material forming the emitting layer and the electron-transporting material forming the electron-transporting layer which contacts the emitting layer is -0.2 eV $< \Delta Ip < 0.4$ eV.

10. The organic electroluminescent device according to claim 1, having a plurality of electron-transporting layers.

11. The organic electroluminescent device according to claim 10, wherein a difference ($\Delta Ip'$), represented by the following expression, in ionization potential between

electron-transporting materials forming two adjacent layers of the plurality of electron-transporting layers is $-0.2\ eV < \Delta Ip' < 0.4\ eV$,

$$\Delta Ip' = Ip\ (i) - Ip\ (i+1)$$

wherein Ip (i) is the ionization potential of an electron-transporting material forming an i-th electron-transporting layer from the emitting layer (i is an integer of 1 or more and (N-1) or less, and N is the number of the electron-transporting layers).

12. The organic electroluminescent device according to claim 10, wherein the optical energy gap (Eg) of an electron-transporting material forming an electron-transporting layer is equal to or smaller than the optical energy gap (Eg) of an electron-transporting material forming the adjacent electron-transporting layer nearer to the emitting layer.

13. The organic electroluminescent device according to claim 10, wherein the triplet energy gap of an electron-transporting material forming an electron-transporting layer is equal to or smaller than the triplet energy gap of an electron-transporting material forming the adjacent electron-transporting layer nearer to the emitting layer.

14. The organic electroluminescent device according to claim 1, wherein the triplet energy gap of the electron-transporting material forming the electron-transporting layer contacting the emitting layer is larger than the triplet energy gap of the metal complex compound of the emitting layer.